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US 4996514 A

US 4985694 A

US 4985693 A

US 4983948 A

(58) Field of search

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(54) Vehicle anti-theft systems

(57) A vehicle anti-theft system comprises: a control means and a remote control means adapted for two-way communication, and a plurality of anti-theft devices which are activated by the control means in response to the presence of an intruder. Thus, the remote control means can activate the control means and thus the anti-theft devices and the control means can alert the remote control means to the presence of an intruder.

The hydraulic braking system may have valves switchable by the user into a uni-directional or bi-directional mode: the former is used for parking or when starting on a hill since releasing the brake pedal will not disengage the brakes in this mode.

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1990.

This print takes account of replacement documents submitted after the date of filing to enable the application to comply with the formal requirements of the Patents Rules 1990.

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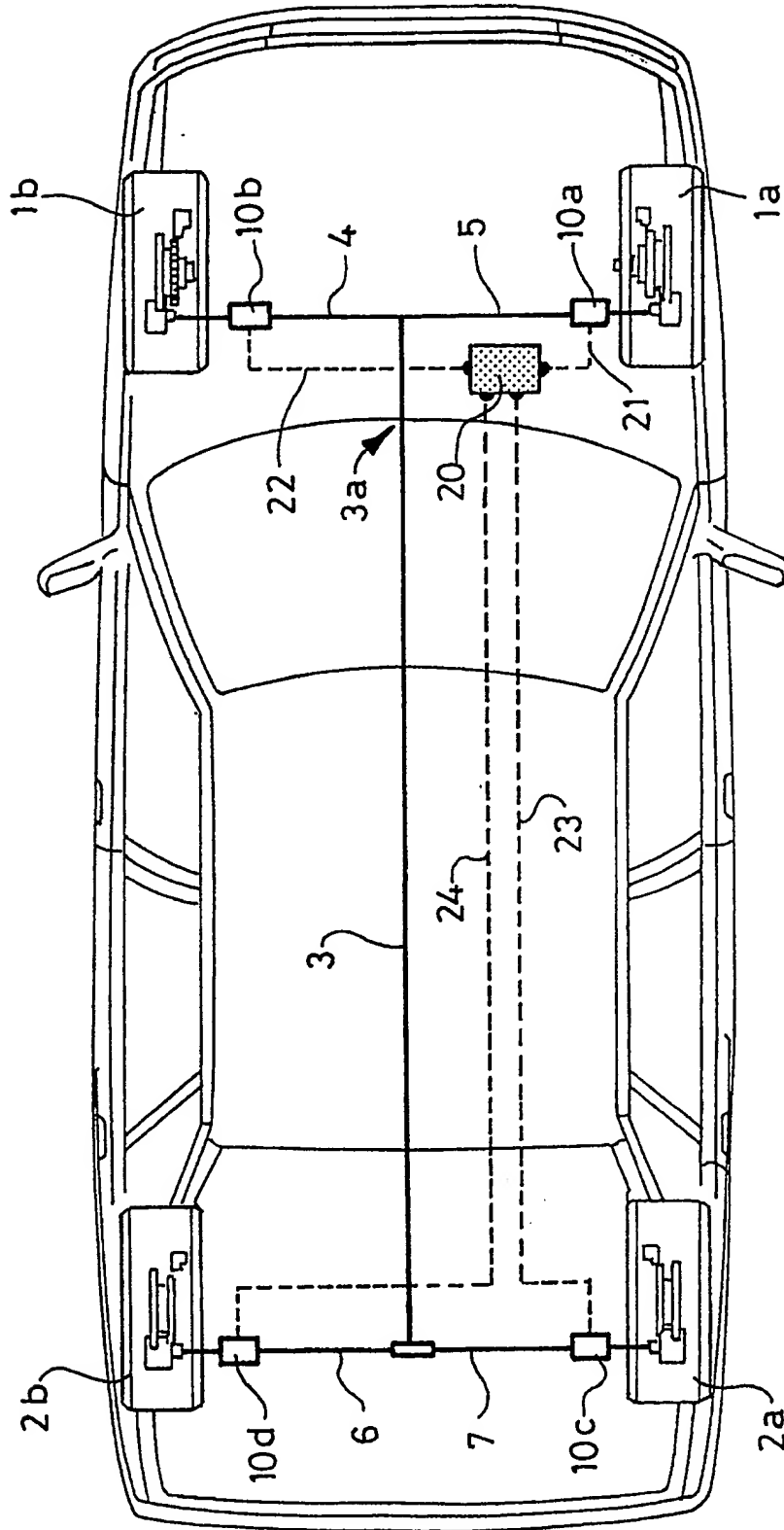


Fig. 1

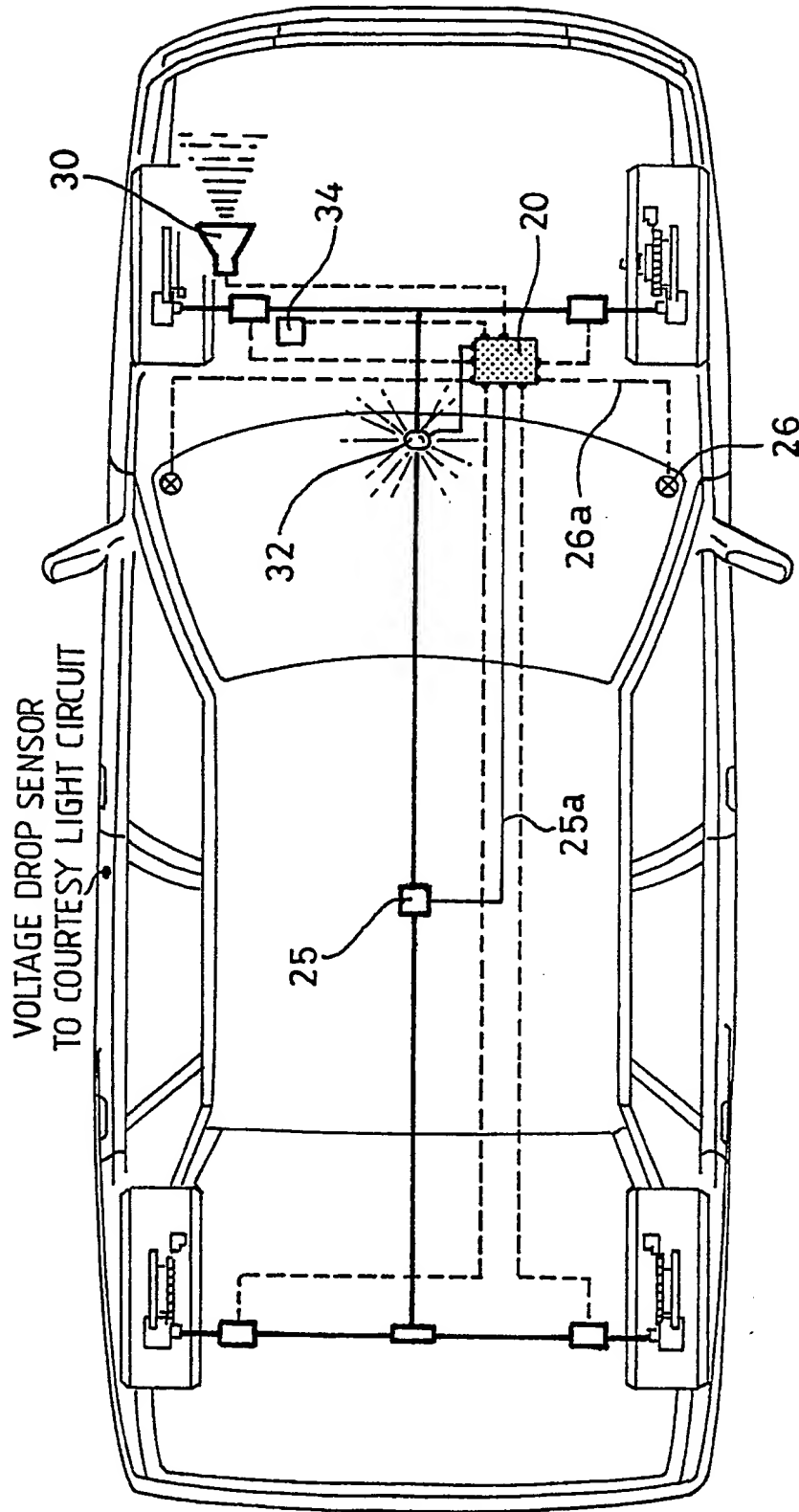
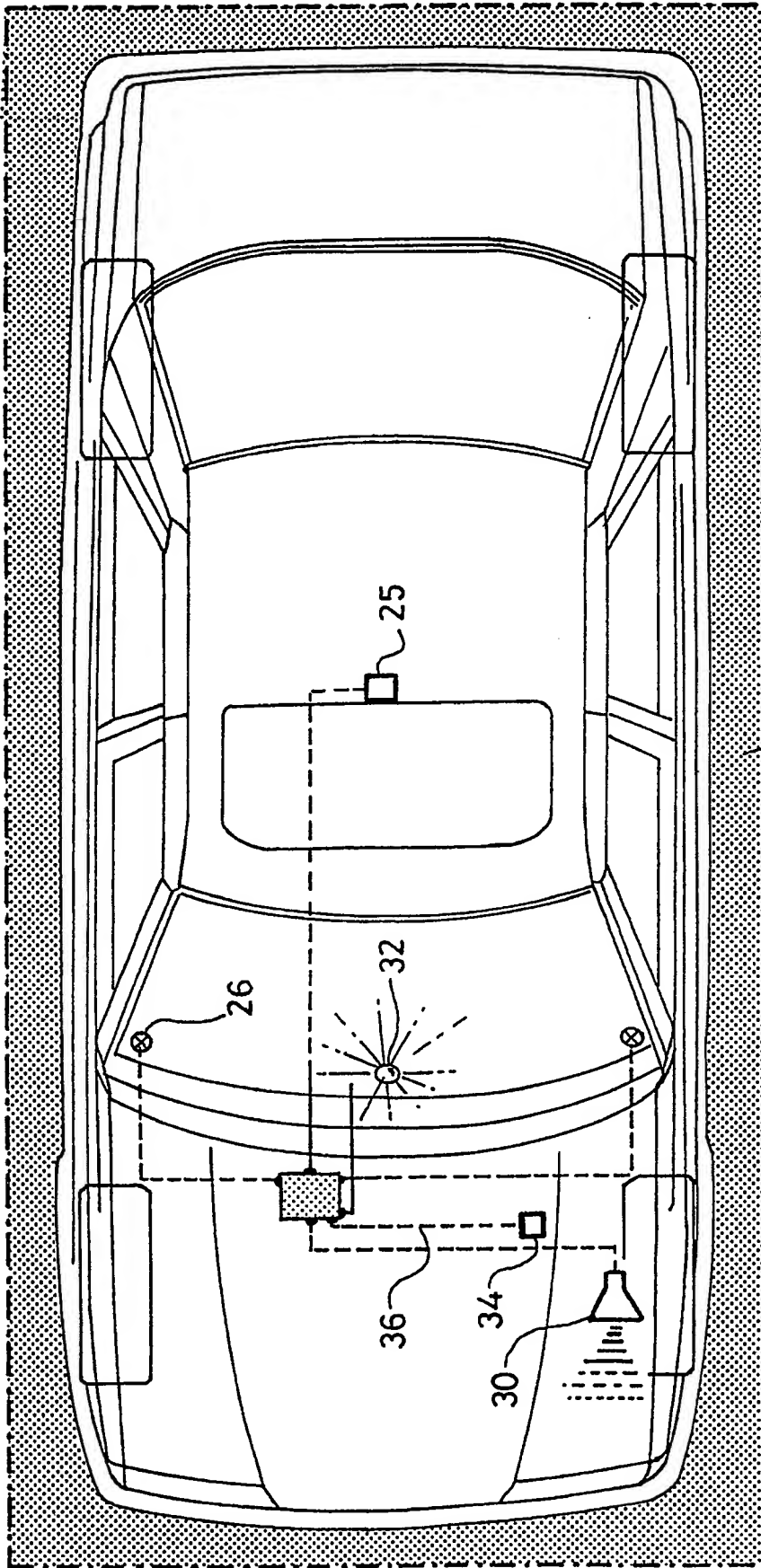


Fig. 2



MICROWAVE PERIMETER
PROTECTION

Fig. 3

IMPROVEMENTS RELATING TO VEHICLE ANTI-THEFT SYSTEMS

The invention relates to vehicle anti-theft systems and particularly, but not exclusively, to a means of operating same using a remote control.

5 The increase in car ownership has been paralleled with an increase in car thefts. Indeed car thefts are so prevalent that it is now known for insurance companies to offer discounts on motor insurance where a vehicle anti-theft system has been fitted in a car. Thus, not only is there a need to equip vehicles with vehicle anti-theft systems, it is
10 also financially advantageous to do so. These facts have encouraged the development of vehicle anti-theft devices. Existing devices include vehicle steering locks and vehicle alarm devices.

Vehicle steering locks are designed to prevent physical manipulation of a steering wheel to which a lock has been fitted and so effectively
15 prevent a thief from removing a vehicle. However, it is possible to disarm such a lock by damaging the vehicle steering column and so be able to steal a car.

Vehicle alarm devices are designed to prevent vehicle theft by the activation of an audible alarm device when a vehicle is tampered with.
20 However, in part, because vehicle alarm devices can be accidentally triggered, the sounding of such alarm tends to have little effect, and in any event vehicle alarm devices can be quickly disabled by a thief once a thief has gained access to the vehicle.

Accordingly there is a need to provide a vehicle anti-theft device
25 which dissuades a thief from trying to gain access to a vehicle and which further prevents a thief from removing a vehicle if access is gained.

According to the invention there is therefore provided a car anti-theft system comprising:

5 a control means for controlling the activation of at least one anti-theft device which device may include an immobilizing means; and a remote control means wherein the remote control means and control means are adapted for the provision of two way communication so that the remote control means can activate the control means and the control means can alert the remote control means to the presence of an intruder.

10 In a preferred embodiment of the invention the immobilizing means comprises a fluid flow controller which is located in one or more of the following lines, the brake line, the clutch line or the fuel feed line. Preferably where the fluid flow controller is located in the brake line it is located near the wheels so as to ensure that the wheels
15 remain locked even if the hydraulic brake line is cut.

Ideally the fluid flow controller is a valve which is adapted for the selective provision of uni-directional or bi-directional flow.

20 Thus immobilization is achieved by the installation of at least one and preferably several hydraulic valves which are situated in the hydraulic brake and/or clutch and/or fluid line of the vehicle. Thus when a valve is configured for uni-directional flow, on depression of for example,
the brake pedal, fluid is made to flow towards the brakes, but is prevented from flowing in an opposite direction away from the brakes resulting in a continuous application of the brakes.
25 When the valve is configured to provide bi-directional flow fluid can flow both to and away from the brakes thus allowing a motorist to apply a braking pressure in a conventional fashion.

In an alternative embodiment of the invention a much simplified and preferred system comprises a valve as afore described incorporated

into a brake calliper. It will be understood that the calliper is adapted for this purpose. The location of the valve and the calliper is ideally at a position just prior to the hydraulic cylinder which actuates the breaking action of the vehicle. The advantage of this arrangement is that there is increased security because the valve assembly is actually part of the brake calliper and therefore cannot be removed without disassembling the brake calliper/disk assembly, hence the entire wheel/hub assembly. The hydraulic efficiency is also improved as the trapped volume, that is the amount of fluid between the valve when closed, and the brake cylinder, is dramatically reduced.

In a further preferred embodiment of the invention the system comprises an anti-theft device in the form of a first detection means which means is responsive to the opening of vehicle access ports such as doors, boots or bonnets. This first detection means is preferably in the form of a sensor adapted to measure drop in voltage in the vehicle which results when an access port is open and a corresponding light is switched on.

In a further embodiment the system also includes an anti-theft device in the form of a second detection means which means is adapted to detect movement in the vicinity of the vehicle by way of the provision of a microwave detector or ultrasonic detector.

Preferably both the first detection means and second detection means are connected to an alarm device so that activation of the detection means results in triggering of the alarm which alarm is preferably either a siren or a voice recording. In the instance where the alarm is a voice recording the system further includes speakers.

Preferably the system also includes an anti-theft device in the form of a flashing light which is ideally a capacitive discharge Xenon lamp which is adapted to provide a constant bright diffused flash from within the vehicle whilst the system is engaged thus warning any

potential intruder that the vehicle is fitted with an anti-theft system in accordance with the invention.

Further, the anti-theft system includes a remote control means and a control means which each comprise a transmitter and receiver preferably for the transmission and reception of radio waves whereby two way communication is achieved.

In a further embodiment of the invention the system also includes what is known as the Hydralock VIP system, which comprises vehicle sensors in the form of microwave, ultrasonic or radio transceivers that are adapted to detect any movement underneath the vehicle and transmit a report of this activity to a remote controller. The advantage of this additional system that is alerts an owner to the possibility of tampering with, amongst other things, the vehicle braking system prior to vehicle entry. Further, it will also alert an owner to the possibility of explosive devices being planted under the vehicle.

In a further embodiment of the invention each vehicle anti-theft device is provided with a code in the form of numbers, letters or any other reference and further the remote control means is provided with corresponding numbers, letters or references whereby a user can selectively activate at least one anti-theft device by sending the corresponding code to the control means which in turn activates the relevant anti-theft device.

Preferably the car anti-theft system is adapted for operation when the vehicle ignition is switched off.

According to a further aspect of the invention there is provided a vehicle auxiliary brake comprising:

at least one flow control means located in the vehicle brake line which control means is adapted in a first condition to provide for a

5 uni-directional flow and in a second condition to provide for bi-directional flow; and an activation means connected to the fluid control means whereby a user can select the condition of the control means and so provide for either uni-directional flow and thus the maintenance of brake pressure when brakes are applied or bi-directional flow and thus the conventional application and release of brake pressure when the brakes are applied and released respectively.

10 In a preferred embodiment the fluid flow controller is a valve which is ideally located near the wheels and which is preferably adapted to function only when the ignition of the vehicle is on.

An embodiment of the invention will now be described by way of example only with reference to the accompanying drawings wherein:

Figure 1 is an underview of a vehicle fitted with an auxiliary braking system in accordance with the invention.

15 Figure 2 is an underview of a vehicle fitted with a number of anti-theft devices in accordance with the invention; and

Figure 3 is a plan view of a vehicle fitted with a number of anti-theft devices in accordance with the invention.

20 Referring to the drawings and firstly to Figure 1 there is illustrated the underview of a vehicle including front wheels 1a, 1b and rear wheels 2a, 2b. Wheels 1a, 1b and 2a, 2b are mounted in conventional fashion and they are provided with conventional braking means which may or may not be anti-lock brake systems. Accordingly, braking of the afore wheels is effected via an hydraulic braking system and to
25 this end there is provided a central hydraulic brake pipe 3 whose axis is parallel to the longitudinal axis of the vehicle. At the fore end 3a of brake pipe 3 the pipe diverges to provide two front wheel brake pipes 4 and 5. Front brake pipe 5 communicates with the braking

system associated with the front wheel 1a and front brake pipe 4 communicates with a braking system associated with front wheel 1b.

Similarly, towards the rear of the vehicle central break pipe 3 diverges to provide two rear wheel brake pipes 6 and 7. Pipe 7 communicates with the braking system associated with rear wheel 2a and pipe 6 communicates with the braking system associated with the rear wheel 2b.

In accordance with the invention there is provided in the aforementioned conventional hydraulic braking system an auxiliary braking means in accordance with the invention. This means comprises the inclusion of at least one, and in Figure 1 there is illustrated four hydraulic fluid flow control means 10a, 10b, 10c and 10d. These fluid flow control means are valves which can operate so as to allow either uni-directional flow or bi-directional flow. As can be seen by reference to Figure 1 each valve is located in close proximity to a vehicle wheel, this is particularly advantageous since it increases the likelihood of the functional effect of the valve being maintained if the hydraulic braking system is damaged at a position remote from the valve. This will be understood with reference to the following description.

Communicating with each valve is a central processing and switching unit 20. Unit 20 communicates with valve 10a via communication line 21; and with means 10b via communication line 22; and with means 10c via communication line 23; and finally with means 10d via communication line 24. In the preferred embodiment of the invention the control of the flow control means is effected by electrical activation of the relevant valves. Thus communication lines 21, 22, 23 and 24 are electrical cables and the flow control means are adapted to respond in conventional manner to electrical signals so as to alter the configuration of the said valves.

In use, the system operates as follows:

A user wishing to immobilize the vehicle may do so by operating an appropriate switch located on the central processing and switching unit 20 which will in turn send an electrical signal down at least one of lines 21, 22, 23, 24, and preferably all four of these lines, so as to bring about activation of the corresponding flow control means 10a, 10b, 10c and 10d. This activation will bring about a change in configuration of the relevant valve so as to change from a configuration allowing bi-directional flow to a configuration allowing only uni-directional flow. Thus, once unit 20 has been thus activated, when a user applies the brakes in conventional fashion, by depressing the break pedal, fluid will be made to flow from the central system via the central brake pipe 3, via pipes 4, 5, 6 and 7 to the associated wheel brakes thus braking the wheels. However, since the valves now occupy a uni-directional configuration, return flow of hydraulic fluid is prevented and the brakes remain in a locked configuration.

It will be understood that it is possible to use the afore described braking system not only for parking purposes but also to ensure that the brakes are applied for a limited time when a motorist is starting the car on a hill since the brakes can be maintained until the relevant switch on central processing and switching unit 20 is de-activated. It will appreciate from this that the auxiliary braking system may be particularly useful to individuals who find the use of a hand brake an imprecise and tedious operation.

Although the braking system has been described with reference to a simple switch in a further preferred embodiment of the invention a code may be used to activate the central processing and switching unit 20 and therefore provide for greater security since only an authorized user will then have access to unit 20 and so be able to selectively disable the activated braking system. Thus the braking system can be used for the purpose of security so as to immobilize a vehicle once it has been parked.

The vehicle anti-theft system in accordance with the invention is also illustrated in Figures 2 and 3 and referring firstly to Figure 2 it can be seen that the system includes a number of other anti-theft devices which are also controlled by means of central processing and switching unit 20. Thus in addition to the braking system already described there is also provided a microwave transceiver 25 and ultrasonic transceiver 26. Transceivers 25 and 26 are connected to unit 20 via communication lines 25a and 26a. Transceivers 25 and 26 are adapted to monitor the environment in the vicinity of a vehicle, ie up to 4ft radius, in order to detect the approach of an individual, it therefore follows that the transceivers operate in conventional fashion. Once transceivers 25 and 26 are activated they relay information via communication lines 25a, 26a to the unit 20 so as to operate a time delay circuit. An individual approaching the vehicle therefore has a pre-determined amount of time in which to disarm control unit 20. In the case of an unauthorized individual this will not be possible and the control unit will then activate one or all of the following anti-theft devices:-

the aforementioned vehicle braking system, an audible alarm 30 in the form of a speaker/siren and/or a Xenon lamp 32.

In the instance where an authorized individual approaches the vehicle the time delay will allow the authorized individual to disarm the unit 20 and the aforementioned alarm devices will not be activated.

In a further preferred embodiment of the invention control unit 20 is adapted so as to periodically activate the Xenon lamp 32 so as to provide for periodic activation of the lamp when an owner leaves a vehicle unattended.

It will be understood that the alarm sounded by the speaker may be of any form and may include a voice message record and stored in a

voice recording chip located in the control unit 20. Typically, the alarm will sound at approximately 120 Db.

5 In addition to the above mentioned anti-theft devices the vehicle control unit 20 may also be coupled to the vehicle lighting system, which is typically activated when an access port such as a door, boot or bonnet of a vehicle is opened. Thus, it is possible to monitor whether access has been gained to the vehicle by monitoring the voltage to lighting apparatus associated with the vehicle door, boot or bonnet. It therefore follows that once access has been gained to the vehicle the control unit 20 will be activated so as to bring about activation of at least one and preferably all of the aforementioned anti-theft devices.

10 In yet a further preferred embodiment of the invention control unit 20 will also be coupled to the vehicle door, boot, bonnet and sun-roof locks so as to automatically activate these locks once the unit is activated.

15 Further there is also provided a movement sensor in the form of a mercury switch 34 to detect movement of the vehicle. Switch 34 is coupled to unit 20 via line 36 so as to activate at least one alarm device when movement of the car is detected.

20 In the afore description the anti-theft system has been described by reference to a control unit 20 having a time delay feature so as to allow an authorized user to gain access to the vehicle and de-activate unit 20 and so prevent any of the anti-theft devices being operated. However, the invention also provides for the provision of a remote control device in the form of a conventional hand-held remote control device, which device is provided with a transmitter and a receiver so as to transmit and receive radio waves to the control unit 20 and receive radio waves emanating from control unit 20. It therefore follows that control unit 20 is similarly provided with a transmitter

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and receiving device adapted to communicate with the remote control means. Thus, the owner of a vehicle can activate any of the aforementioned anti-theft devices from a remote position and further can de-activate the anti-theft devices when approaching the vehicles.

5 Further, since the control unit 20 is also provided with a transmitter and receiver control unit 20 is adapted to communicate interactively with the remote control means so that upon the detection of an unauthorized individual control unit 20 can alert the remote control means which in turn alerts the vehicle owner to the potential theft of
10 his vehicle. This particular feature is of significant advantage in the control of vehicle thefts since it will enable an owner to monitor his vehicle and also estimate at approximately what time an intruder attempted to interfere with or steal his vehicle.

15 The remote control means is ideally provided with a keypad which can be used to transmit information to unit 20. Further, the remote control unit will include a liquid crystal display in any of the conventional means which facilitate communication between the remote control and the central unit 20. The remote control is operated by way of batteries and there is therefore provided within the vehicle a
20 battery recharger so that the remote control can be recharged during use of the vehicle. To this end the vehicle is provided with a battery recharger including a receptacle which is adapted to accommodate the size and shape of the remote control means.

25 As a further safety feature the control unit is provided with a checking system which will receive and check incoming signals and if an incorrect signal is sent to the unit 20, unit 20 will respond by indicating to the remote control means that an alternative signal needs to be sent. If an acceptable or correct signal is sent to central unit 20 then the unit will allow further information to be received, which
30 information activates the anti-theft devices. Thus, control unit 20 is provided with a two-steps system of operation, the first step being

provided for security purposes. In addition, the central unit 20 may be provided with a time delay circuit which allows access to the anti-theft devices within a pre-determined time after successful completion of the first step process.

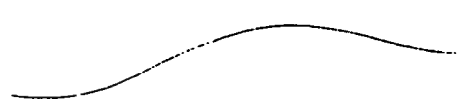
5 Further the system may also be configured to allow an owner to speak into his remote control and have the spoken message relayed via unit 20 to the speaker in the audible alarm device thus, an owner can warn away intruders from a distance.

10 The effective range of the remote control means will be greater than 300ft.

In yet a further preferred embodiment of the invention control unit 20 will be configured so as to only allow disabling of the auxiliary brake system when the ignition key is in the ON position.

15 In addition to all the previously mentioned sensing devices and facilities, the Hydralock VIP system will have under vehicle sensors, which may be microwave, ultrasonic or radio frequency transceivers to detect any movement underneath the vehicle and transmit a report of this information to the remote controller. The purpose of this is to make the passengers aware of possible tempering with the braking
20 system etc, prior to their entry of the vehicle, or to make the passengers aware of the possibility of explosives being planted under the vehicle.

25 It can therefore be seen by reference to the above that the invention provides for a comprehensive vehicle anti-theft system which has been designed to maximize the security of an unattended vehicle.



CLAIMS

1. A vehicle anti-theft system comprising: a control means for controlling the activation of at least one anti-theft device in response to the presence of an intruder, and a remote control means wherein the remote control means and control means are adapted for the provision of two-way communication so that the remote control means can activate the control means and the control means can alert the remote control means to the presence of an intruder.

2. A vehicle anti-theft system according to Claim 1 wherein, the anti-theft device comprises an immobilizing means including fluid flow controller located in the brake line.

3. A vehicle anti-theft system according to Claim 2 wherein, the fluid flow controller is located adjacent at least one vehicle wheel.

4. A vehicle anti-theft system according to Claim 3 wherein, the fluid flow controller is located in the brake calliper.

5. A vehicle anti-theft system according to Claim 2 wherein, the fluid flow controller is located in the clutch line.

6. A vehicle anti-theft system according to Claim 2 wherein, the fluid flow controller is located in the fuel feed line.

7. A vehicle anti-theft system according to Claims 2 to 6 wherein, the fluid flow controller is a valve adapted for the selective provision of uni-directional or bi-directional flow.
- 5 8. A vehicle anti-theft system according to Claim 1 wherein, the anti-theft device comprises a detection means responsive to the opening of a vehicle access port.
9. A vehicle anti-theft system according to Claim 8 wherein, the detection means is responsive to a change in voltage as a result of the opening of said access port.
- 10 10. A vehicle anti-theft system according to Claim 1 wherein, the anti-theft device comprises a sensing means adapted to sense movement in the vicinity of a vehicle.
- 15 11. A vehicle anti-theft system according to Claim 10 wherein, the sensing means operates by virtue of a microwave detector or ultrasonic detector.
12. A vehicle anti-theft system according to Claim 1 wherein, the anti-theft device comprises an alarm means.
13. A vehicle anti-theft system according to Claim 12 wherein, the alarm means is a siren.
- 20 14. A vehicle anti-theft system according to Claim 12 wherein, the alarm means is a voice recording.
15. A vehicle anti-theft system according to Claim 14 wherein, the alarm means is provided with speakers.
- 25 16. A vehicle anti-theft system according to Claim 1 wherein, the anti-theft device comprises a flashing light.

17. A vehicle anti-theft system according to Claim 16 wherein, the light is a capacitive discharge Xenon lamp.

5 18. A vehicle anti-theft system according to Claim 1 wherein, the anti-theft device is a sensing means adapted to detect movement underneath a vehicle.

19. A vehicle anti-theft device according to Claim 1 wherein, the control means and the remote control means includes a transmitter and a receiver for the transmission and reception of radio waves.

10 20. A vehicle anti-theft system according to Claim 1 wherein, said anti-theft device is provided with a code stored in the control means which code is accessible by the remote control means so as to selectively activate the corresponding anti-theft device.

15 21. A vehicle anti-theft system according to any preceding Claim wherein, the system is adapted for operation when the vehicle ignition is switched off.

20 22. A vehicle auxiliary braking system comprising: at least one flow control means located in the vehicle brake line which control means is adapted in a first condition to provide for a uni-directional flow and in a second condition to provide for bi-directional flow; and an activation means connected to the fluid control means whereby a user can select the condition of the control means and so provide for either uni-directional flow and thus the maintenance of brake pressure when brakes are applied or bi-directional flow and thus the conventional application and release of brake pressure when the brakes are applied and released respectively.

25 23. A vehicle auxiliary braking system according to Claim 22 wherein, the fluid flow controller is a valve located adjacent at least one vehicle wheel.

24. A vehicle auxiliary braking system according to Claim 22 or Claim 23 wherein, the system is adapted to function only when the ignition of the vehicle is on.

Amendments to the claims have been filed as follows

1. A vehicle anti-theft system comprising: a control means for controlling the activation of at least one anti-theft device in response to the presence of an intruder, and a remote control means wherein the remote control means and control means are adapted for the provision of interactive two-way communication so that the remote control means can activate the control means and thus a pre-selected anti-theft device and the control means can alert the remote control means to the presence of an intruder.
2. A vehicle anti-theft system according to Claim 1 wherein, the anti-theft device comprises an immobilizing means including fluid flow controller located in the brake line.
3. A vehicle anti-theft system according to Claim 2 wherein, the fluid flow controller is located adjacent at least one vehicle wheel.
4. A vehicle anti-theft system according to Claim 3 wherein, the fluid flow controller is located in the brake calliper.
5. A vehicle anti-theft system according to Claim 2 wherein, the fluid flow controller is located in the clutch line.
6. A vehicle anti-theft system according to Claim 2 wherein, the fluid flow controller is located in the fuel feed line.



7. A vehicle anti-theft system according to Claims 2 to 6 wherein, the fluid flow controller is a valve adapted for the selective provision of uni-directional or bi-directional flow.

5 8. A vehicle anti-theft system according to Claim 1 wherein, the anti-theft device comprises a detection means responsive to the opening of a vehicle access port.

9. A vehicle anti-theft system according to Claim 8 wherein, the detection means is responsive to a change in voltage as a result of the opening of said access port.

10 10. A vehicle anti-theft system according to Claim 1 wherein, the anti-theft device comprises a sensing means adapted to sense movement in the vicinity of a vehicle.

15 11. A vehicle anti-theft system according to Claim 10 wherein, the sensing means operates by virtue of a microwave detector or ultrasonic detector.

12. A vehicle anti-theft system according to Claim 1 wherein, the anti-theft device comprises an alarm means.

13. A vehicle anti-theft system according to Claim 12 wherein, the alarm means is a siren.

20 14. A vehicle anti-theft system according to Claim 12 wherein, the alarm means is a voice recording.

15. A vehicle anti-theft system according to Claim 14 wherein, the alarm means is provided with speakers.



16. A vehicle anti-theft system according to Claim 1 wherein, the anti-theft device comprises a flashing light.

17. A vehicle anti-theft system according to Claim 16 wherein, the light is a capacitive discharge Xenon lamp.

5 18. A vehicle anti-theft system according to Claim 1 wherein, the anti-theft device is a sensing means adapted to detect movement underneath a vehicle.

10 19. A vehicle anti-theft device according to Claim 1 wherein, the control means and the remote control means includes a transmitter and a receiver for the transmission and reception of radio waves.

20. A vehicle anti-theft system according to Claim 1 wherein, said anti-theft device is provided with a code stored in the control means which code is accessible by the remote control means so as to selectively activate the corresponding anti-theft device.

15 21. A vehicle anti-theft system according to any preceding Claim wherein, the system is adapted for operation when the vehicle ignition is switched off.

20 22. A vehicle auxiliary braking system comprising: at least one flow control means located in the vehicle brake line which control means is adapted in a first condition to provide for a uni-directional flow and in a second condition to provide for bi-directional flow; and an activation means connected to the fluid control means whereby a user can select the condition of the control means and so provide for either uni-directional flow and thus the maintenance of brake pressure when brakes are applied
25 or bi-directional flow and thus the conventional application and release of brake pressure when the brakes are applied and released respectively.

23. A vehicle auxiliary braking system according to Claim 22 wherein, the fluid flow controller is a valve located adjacent at least one vehicle wheel.

5 24. A vehicle auxiliary braking system according to Claim 22 or Claim 23 wherein, the system is adapted to function only when the ignition of the vehicle is on.

Patents Act 1977
E. Examiner's report to the Comptroller under
Section 17 (The Search Report)

Application number

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Relevant Technical fields

(i) UK Cl (Edition L) G4H (HRCE, HRCS, HTG)

(ii) Int Cl (Edition 5) B6OR

Databases (see over)

(i) UK Patent Office

(ii)

Search Examiner

M J DAVIS

Date of Search

25 JUNE 1993

Documents considered relevant following a search in respect of claims

1-21

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	US 4996514 (SUNAMI) Whole document	1 at least
X	US 4985694 (SUNAMI) Whole document	1 at least
X	US 4985693 (SUNAMI) Whole document	1 at least
X	US 4983948 (SUNAMI) Whole document	1 at least

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

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